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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 218	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/KR 2004/001086	International filing date (day/month/year) 11 May 2004 (11.05.2004)	Priority Date (day/month/year) 6 December 2003 (06.12.2003)
International Patent Classification (IPC) or national classification and IPC IPC⁸: C08G 61/00 (2006.01), C12P 1/00 (2006.001)		
Applicant KOREA RESEARCH INSTITUTE OF CHEMICAL TECHNOLOGY et al. □□□□□□		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examination Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>4</u> sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of <u>1</u> sheets.</p> <p>3. This report contains indications relating to the following items:</p> <p>I. <input checked="" type="checkbox"/> Basis of the opinion</p> <p>II. <input type="checkbox"/> Priority</p> <p>III. <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV. <input type="checkbox"/> Lack of unity of invention</p> <p>V. <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI. <input type="checkbox"/> Certain documents cited</p> <p>VII. <input type="checkbox"/> Certain defects in the international application</p> <p>VIII. <input type="checkbox"/> Certain observations on the international application</p>		
Date of submission of the demand 01.07.2005	Date of completion of this report 2 January 2006 (02.01.2006)	
Name and mailing address of the IPEA/AT Austrian Patent Office Dresdner Straße 87 A-1200 Vienna Facsimile No. 1/53424/200	Authorized officer BAUMSCHABL F. Telephone No. 1/53424/459	

Form PCT/IPEA/409 (cover sheet) (July 1998)

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International application No.

PCT/KR 2004/001086

I. Basis of the report

1. With regard to the **elements** of the international application:*

☐ the international application as originally filed

☒ the description:

pages 2-12, as originally filed

pages 1, filed with the demand

pages _____, filed with the letter of _____.

☒ the claims:

pages 13, as originally filed

pages _____, as amended (together with any statement) under Article 19

pages _____, filed with the demand

pages _____, filed with the letter of _____.

☒ the drawings:

pages 1, 2, as originally filed

pages _____, filed with the demand

pages _____, filed with the letter of _____.

☐ the sequence listing part of the description:

pages _____, as originally filed

pages _____, filed with the demand

pages _____, filed with the letter of _____.

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language English which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in printed form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☒ The amendments have resulted in the cancellation of:

☒ the description, pages 1.

☐ the claims, Nos. _____.

☐ the drawings, sheets/fig _____.

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as „originally filed“ and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

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PCT/KR 2004/001086**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement	Novelty (N)	Claims 1-8	YES
		Claims ----	NO
	Inventive step (IS)	Claims 1-8	YES
		Claims ----	NO
	Industrial applicability (IA)	Claims 1-8	YES
		Claims ----	NO

Citations and explanations (Rule 70.7)

US 4 900 671 A comprises a process for the preparation of a phenolic resin reacting a phenol with a peroxidase or an oxidase enzyme in an organic solvent. US 4 900 671 A does not teach phenothiazine as mediator for the polymerization reaction.

US 5824 414 A relates to a reaction of phenols with hydrogen peroxide, an organic solvent compatible with water, water, a peroxidase and a dispersing agent. Phenothiazine derivatives are not mentioned in this document.

JP 2002-201245 A relates to the reaction of hydrophobic phenols with an aldehyde in the presence of a catalyst. Phenothiazine derivatives are not mentioned in this document.

US 5 322 960 A discloses a method for inhibiting polymerizable (meth)acrylic acid and esters thereof from polymerizing during their production and storage by using inhibitors. Different phenothiazine compounds are enumerated [column 2, lines 40 – 45] as inhibitors for this reaction [inhibiting polymerization of acrylic compounds].

US 6 362 315 B2 relates to a process of controlling the molecular weight and dispersity of poly(p-ethylphenol) and poly(m-cresol) synthesized enzymatically by varying the composition of the reaction medium. Phenothiazine derivatives are not mentioned in this document.

JP 11-269254 A [abstract] relates to a process of oxidatively polymerizing a phenol in the presence of a porphyrin-metal complex (e.g. chlorophthemin).

None of the cited documents relates to all features (especially phenolic monomers, peroxidase, oxidant, phenothiazine as mediator) of the process according to claim 1 and the dependent claims 2 to 8. Therefore the subject matter of the present application according to claims 1 to 8 is considered to be new.

Only US 5 322 960 A teaches to use phenothiazine compounds as inhibitor but there is no advice given for a skilled person to use phenothiazines as mediator for phenolic

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Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: **Box V** (page 1)

compounds substituted with unsaturated aliphatic chains. A skilled person is not considered to come to the subject matter of claims 1 to 8 by combining two or more of the cited documents. Therefore claims 1 to 8 are considered to involve an inventive step.

Industrial applicability is given.

This examination report is in accordance with the written opinion (ISA 237) of the International Searching Authority transmitted with the search report.

**PROCESS FOR PREPARING PHENOLIC POLYMER BY USING
PHENOTHIAZINES MEDIATOR**

BACKGROUND OF THE INVENTION**FIELD OF THE INVENTION**

The present invention relates to a process for preparing a phenolic polymer using a phenothiazine-based mediator, in particular, to a process for preparing a phenolic polymer by polymerizing phenolic monomers by use of a phenothiazine-based mediator in the presence of peroxidase biocatalyst and oxidant, thereby dramatically improving the enzyme reactivity of peroxidase.

The phenolic polymers prepared according to the polymerization of this invention maintain unsaturated hydrocarbon groups linked to their side chains, so that they are very useful as a curing resin because they can easily form coatings through radical curing. In addition, the coatings formed using the curing resin have antioxidation effect and lower surface energy, so that they can prevent physical attachment of marine livings. Because the antifouling-causing functional groups are not consumed, the coatings continuously exhibit durability.

DESCRIPTION OF THE RELATED ART

Phenolic polymers are known to be useful as paints and various coating materials, due to their excellent anti-corrosiveness and capability of forming a firm coating.

For synthesizing phenolic polymers chemically, formalin or hexamethylene tetraamine generated by the condensation of formaldehyde and ammonia is employed in high-temperature polymerization. However, such method has some shortcomings in which formalin and formaldehyde are toxic and unreacted